1. **Project Name:** **Development of Advanced Wear and Corrosion Resistant Systems Through Laser Surface Alloying and Materials Simulation**

2. **Lead Organization**: Applied Research Laboratory,
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5. **Date Project Initiated and FY of Effort:** March 1, 2002 – April 30, 2002 (only 1 year)

6. **Expected Completion Date:** June 30, 2002 (with no cost extension)

7. **Project Technical Milestones and Schedule:** (Please provide the milestones/deliverables schedule for your project, both completed and planned.)

ID Number	Task / Milestone Description	Planned Completion	Actual Completion	Comments
1	Phase I (Year 1)			
1.1	Define Material Requirements	12/31/02		Completed
1.2	Develop Materials Model	3/31/03		Completed
1.3	Modify Process Model	3/31/03		Completed
1.4	Validate Models	4/30/03		Near Completion

ID Number	Task / Milestone Description	Planned Completion	Actual Completion	Comments
1.5	Laboratory Demonstration	6/30/99		Completed
1.6	Final Report	7/31/03		Near Completion

8. **Past Project Milestones and Accomplishments:** (Provide a brief description of progress and accomplishments to date, with specific emphasis on progress towards milestones during the past calendar year.)

- The heat transfer model for the laser surface alloying process is completed. . The model utilizes a three-dimensional explicit finite differencing scheme, and utilizes variable grid spacing in two dimensions (the thickness and width) and a fixed spacing in the third dimension (length) to reduce computational time. It is capable of time-dependent analysis, as well as quasi-steady state calculations.
- The stabilities of TiC and WC in a liquid with a martensitic stainless steel composition were evaluated using computational thermodynamic models. This shows that the stability of WC is less than TiC. Further kinetic calculations are being performed to understand the dissolution and coarsening of these carbides. Ongoing experimental results agree with these predictions.

9. **Planned Future Milestones:**

- Activities for the remaining quarter will concentrate on integrating the process and materials models as a tool for development, finalizing validation of the models to accurately predict microstructures, and completing the final report.

10. **Issues/Barriers:**

The experimental results show sensitivity to active shielding gases. The dissolution of these gases including nitrogen in the presence of a laser beam appears to be complex. Ongoing research focuses on extending published models of gaseous dissolution in welds to this issue.

11. **Intended Market and Commercialization Plans/Progress:**

Based on the recent results of the validation experiments, a patent disclosure is being formulated that describes certain unexpected benefits associated with these processing parameters and shielding gases. Upon completion of the disclosure, these benefits will be detailed in the final report.

12. **Patents, publications, presentations:**

No additional publications have been submitted at this time; however, two papers are being planned for submission.